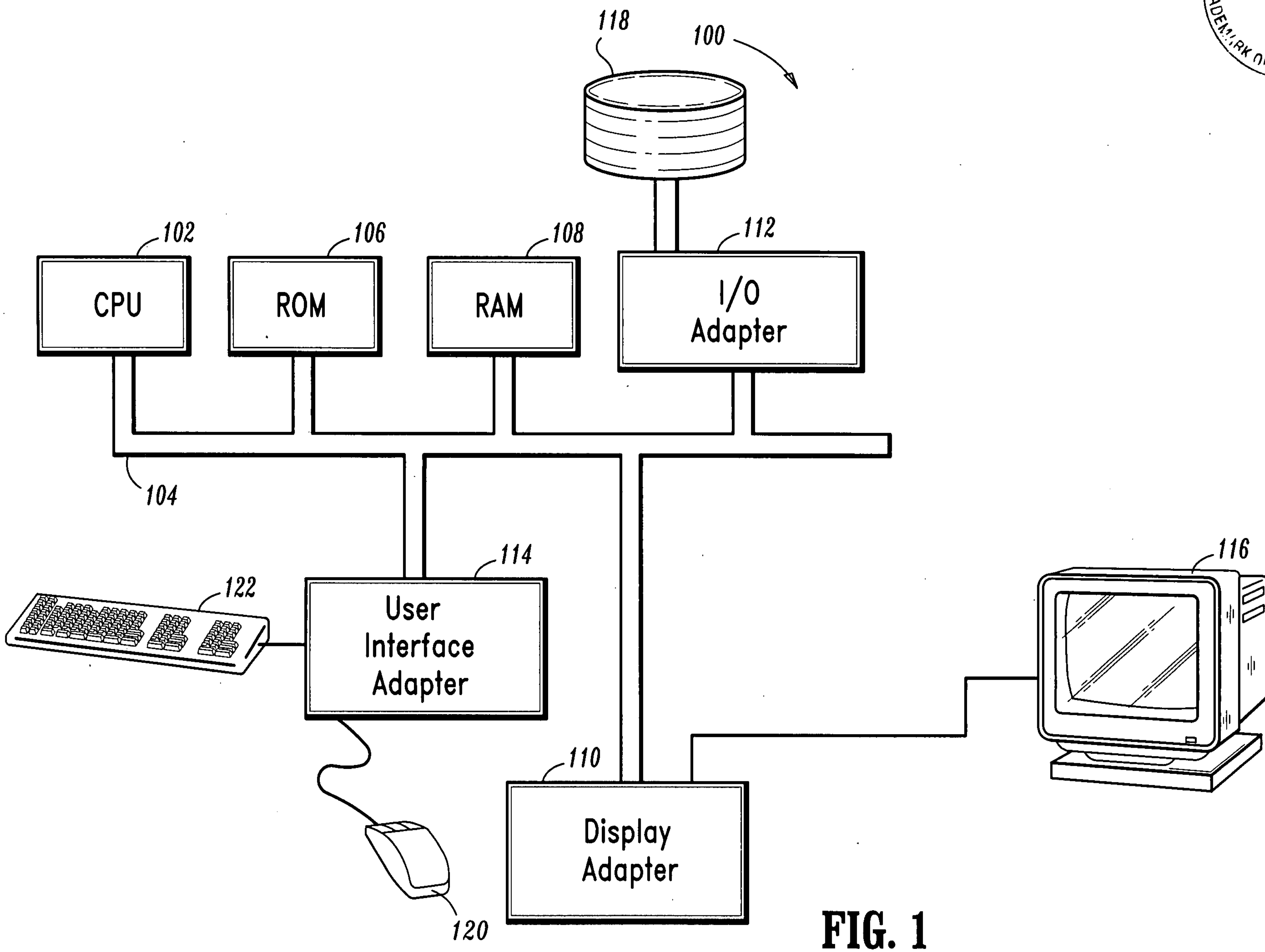

118
100
102
CPU
106
ROM
108
RAM
112
I/O
Adapter
104
114
User
Interface
Adapter
122
110
Display
Adapter
120
116

FIG. 1

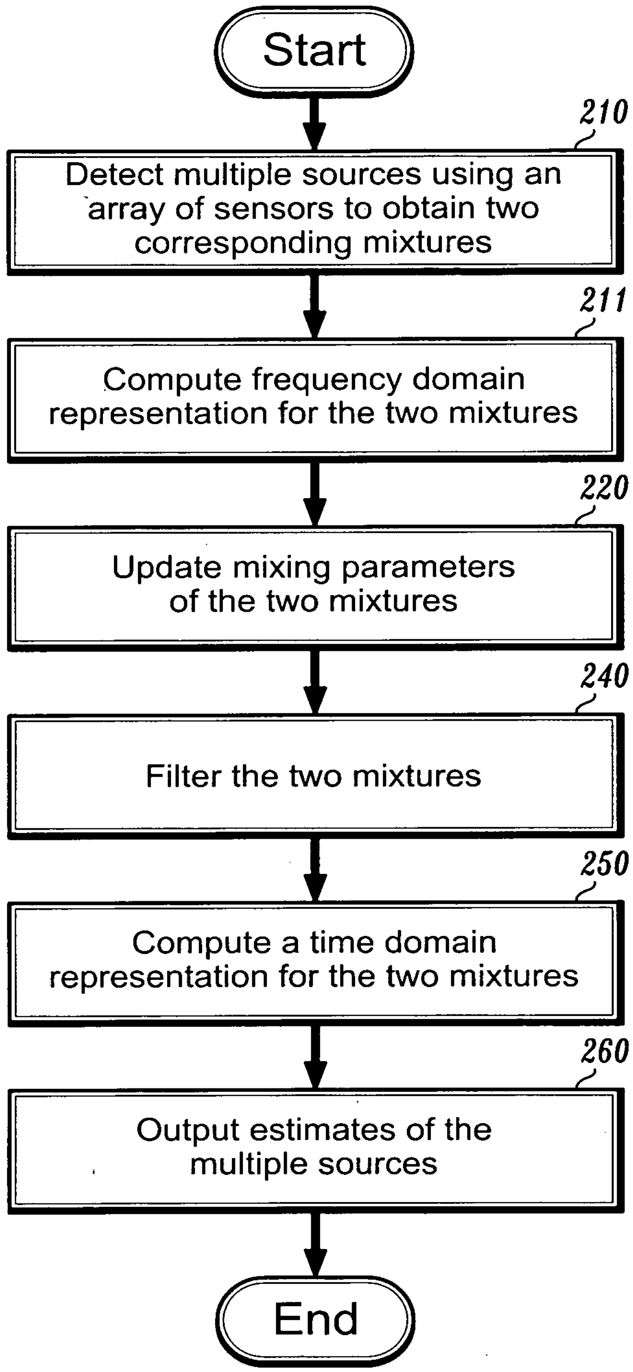

Start
210
Detect multiple sources using an array of sensors to obtain two corresponding mixtures
211
Compute frequency domain representation for the two mixtures
220
Update mixing parameters of the two mixtures
240
Filter the two mixtures
250
Compute a time domain representation for the two mixtures
260
Output estimates of the multiple sources
End

FIG. 2

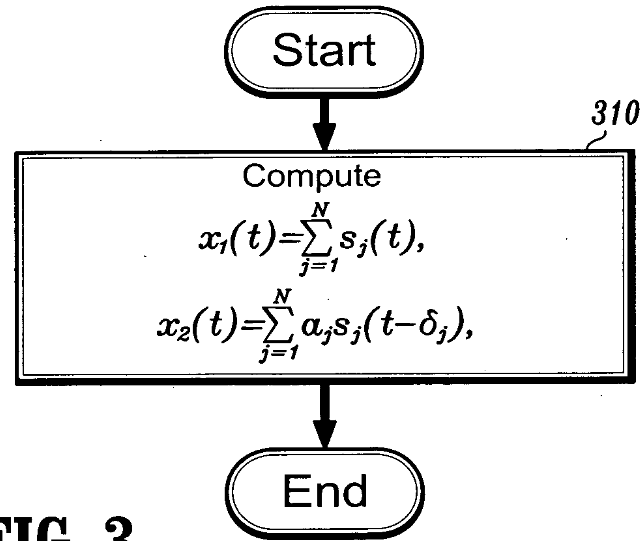


FIG. 3

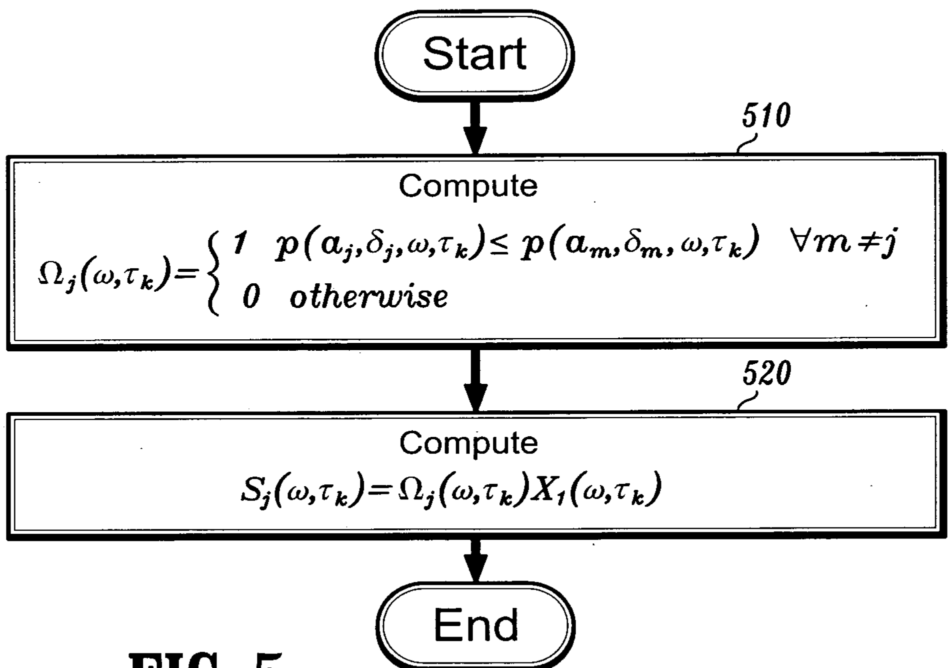


FIG. 5

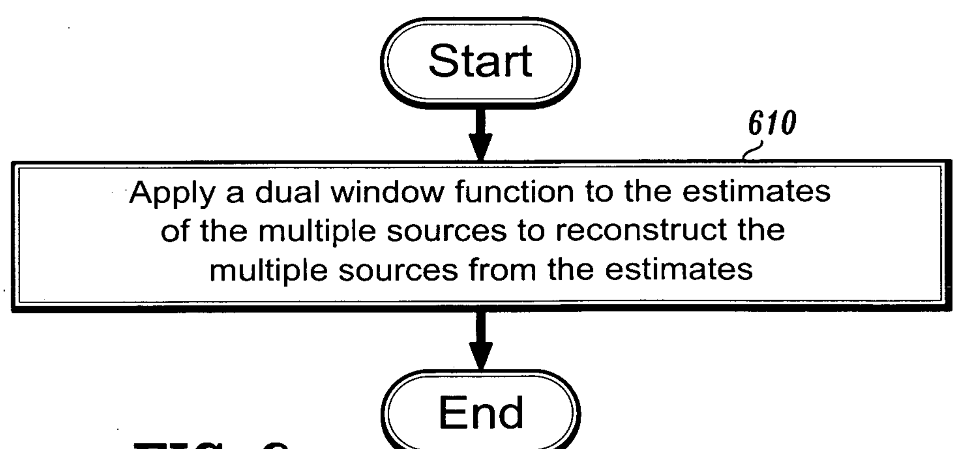
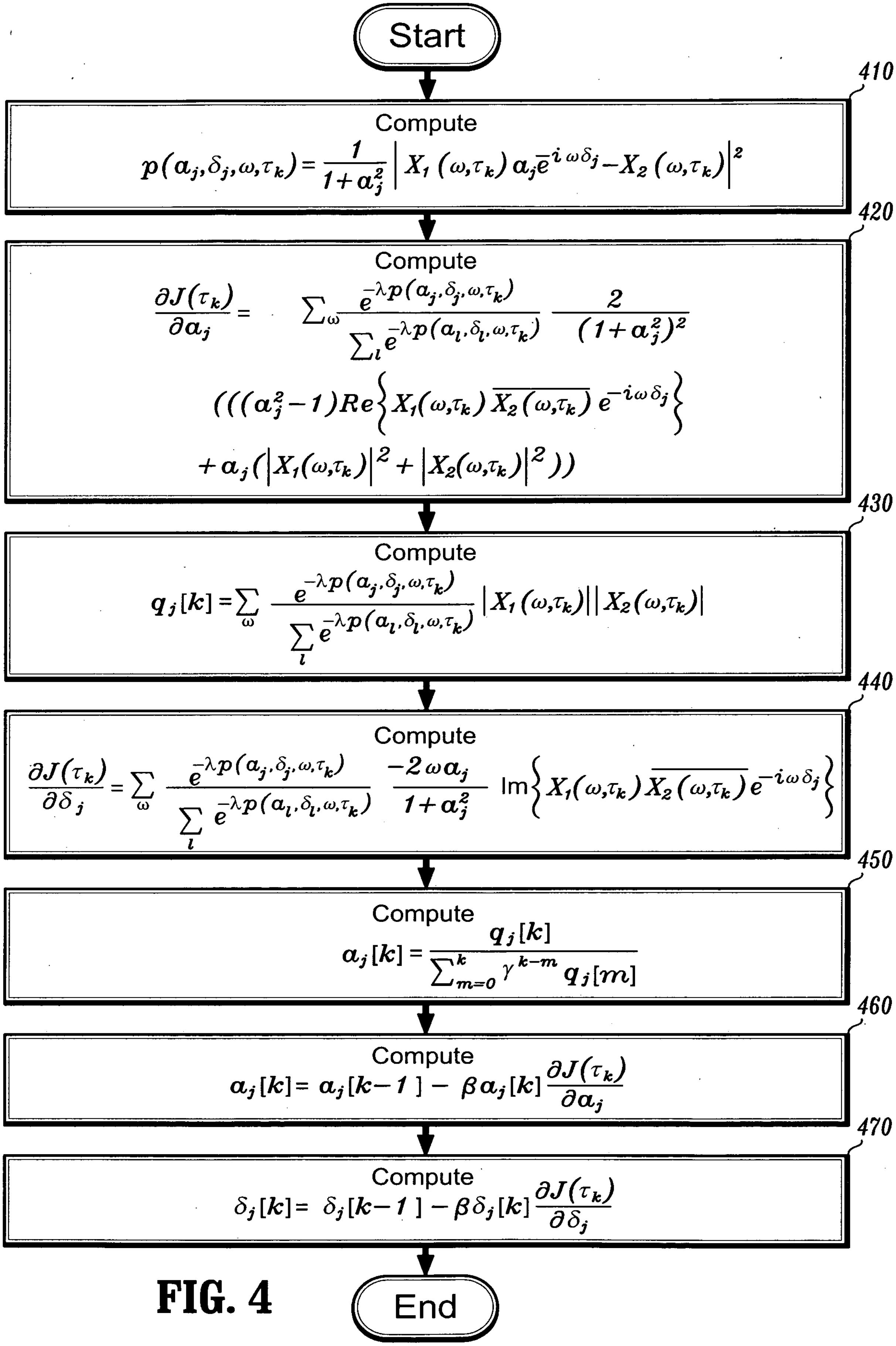


FIG. 6



Start
410
Compute
$p(\alpha_j,\delta_j,\omega,\tau_k) = \frac{1}{1+\alpha_j^2}\left|X_1(\omega,\tau_k)\,\alpha_j e^{-i\omega\delta_j} - X_2(\omega,\tau_k)\right|^2$
420
Compute
$\frac{\partial J(\tau_k)}{\partial \alpha_j} = \sum_\omega \frac{e^{-\lambda p(\alpha_j,\delta_j,\omega,\tau_k)}}{\sum_l e^{-\lambda p(\alpha_l,\delta_l,\omega,\tau_k)}} \frac{2}{(1+\alpha_j^2)^2}$
$(((\alpha_j^2-1)Re\left\{X_1(\omega,\tau_k)\overline{X_2(\omega,\tau_k)}\,e^{-i\omega\delta_j}\right\}$
$+\alpha_j(\left|X_1(\omega,\tau_k)\right|^2 + \left|X_2(\omega,\tau_k)\right|^2))$
430
Compute
$q_j[k] = \sum_\omega \frac{e^{-\lambda p(\alpha_j,\delta_j,\omega,\tau_k)}}{\sum_l e^{-\lambda p(\alpha_l,\delta_l,\omega,\tau_k)}} \left|X_1(\omega,\tau_k)\right|\left|X_2(\omega,\tau_k)\right|$
440
Compute
$\frac{\partial J(\tau_k)}{\partial \delta_j} = \sum_\omega \frac{e^{-\lambda p(\alpha_j,\delta_j,\omega,\tau_k)}}{\sum_l e^{-\lambda p(\alpha_l,\delta_l,\omega,\tau_k)}} \frac{-2\omega\alpha_j}{1+\alpha_j^2} \mathrm{Im}\left\{X_1(\omega,\tau_k)\overline{X_2(\omega,\tau_k)}\,e^{-i\omega\delta_j}\right\}$
450
Compute
$a_j[k] = \frac{q_j[k]}{\sum_{m=0}^{k} \gamma^{k-m} q_j[m]}$
460
Compute
$\alpha_j[k] = \alpha_j[k-1] - \beta a_j[k]\frac{\partial J(\tau_k)}{\partial \alpha_j}$
470
Compute
$\delta_j[k] = \delta_j[k-1] - \beta\delta_j[k]\frac{\partial J(\tau_k)}{\partial \delta_j}$
End

FIG. 4

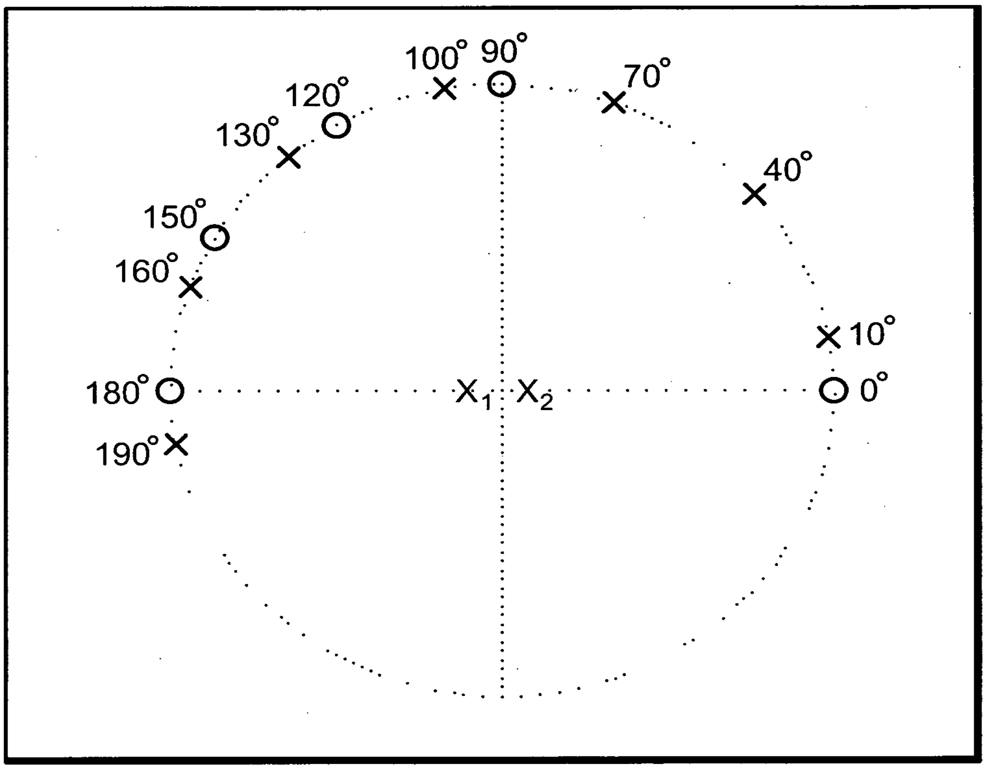


FIG. 7

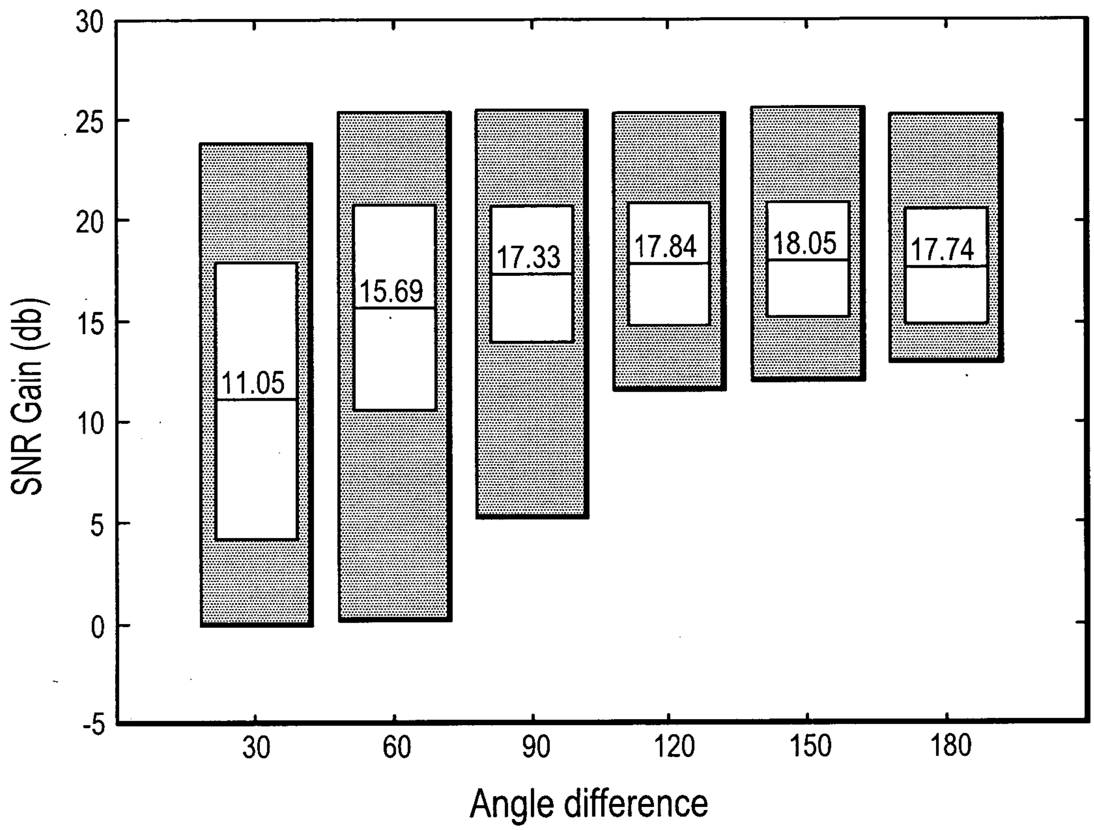

30
25
20
15
10
5
0
-5
SNR Gain (db)
11.05
15.69
17.33
17.84
18.05
17.74
30
60
90
120
150
180
Angle difference

FIG. 8

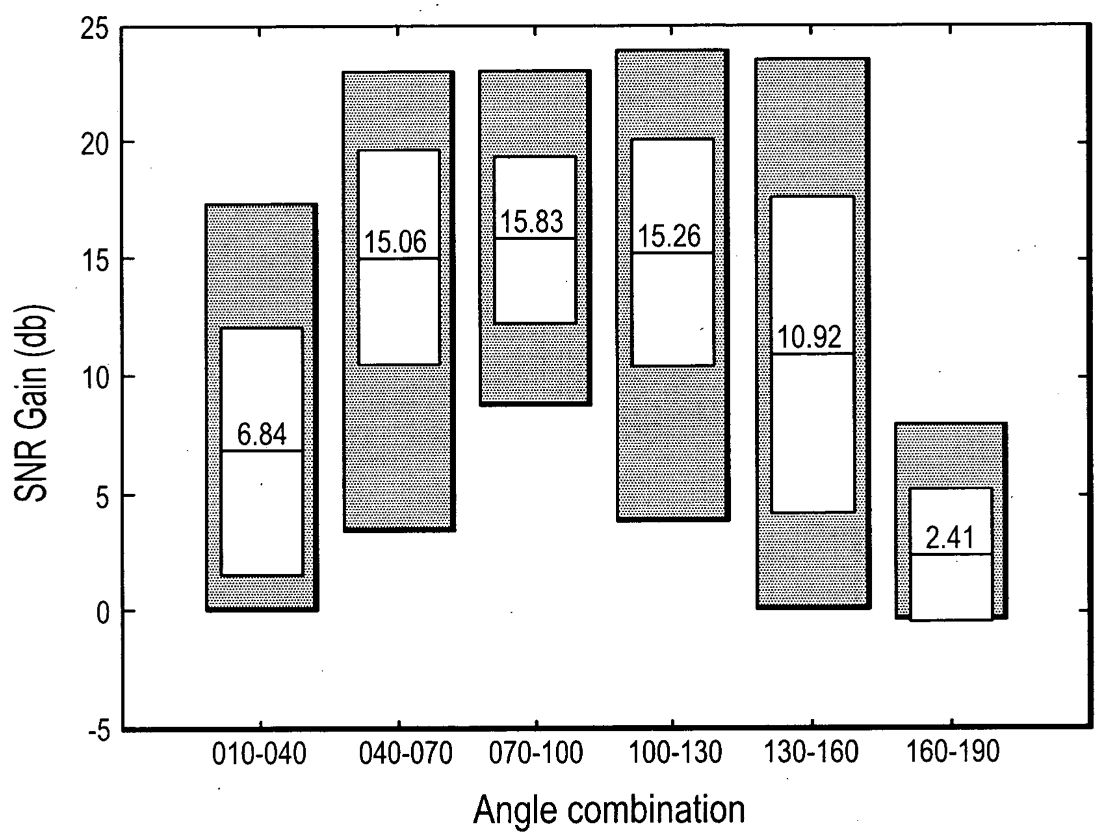
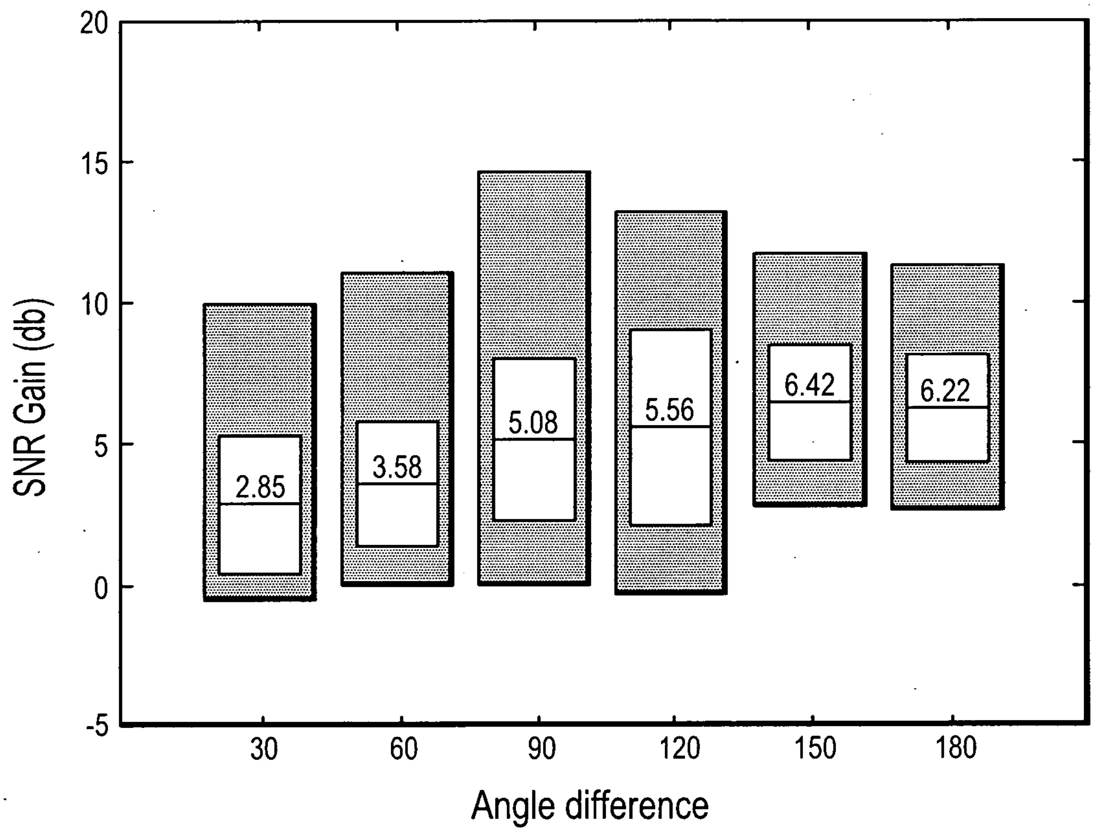

25
20
15
10
5
0
-5
SNR Gain (db)
6.84
15.06
15.83
15.26
10.92
2.41
010-040
040-070
070-100
100-130
130-160
160-190
Angle combination

FIG. 9



20
15
10
5
0
-5
SNR Gain (db)
2.85
3.58
5.08
5.56
6.42
6.22
30
60
90
120
150
180
Angle difference

FIG. 10

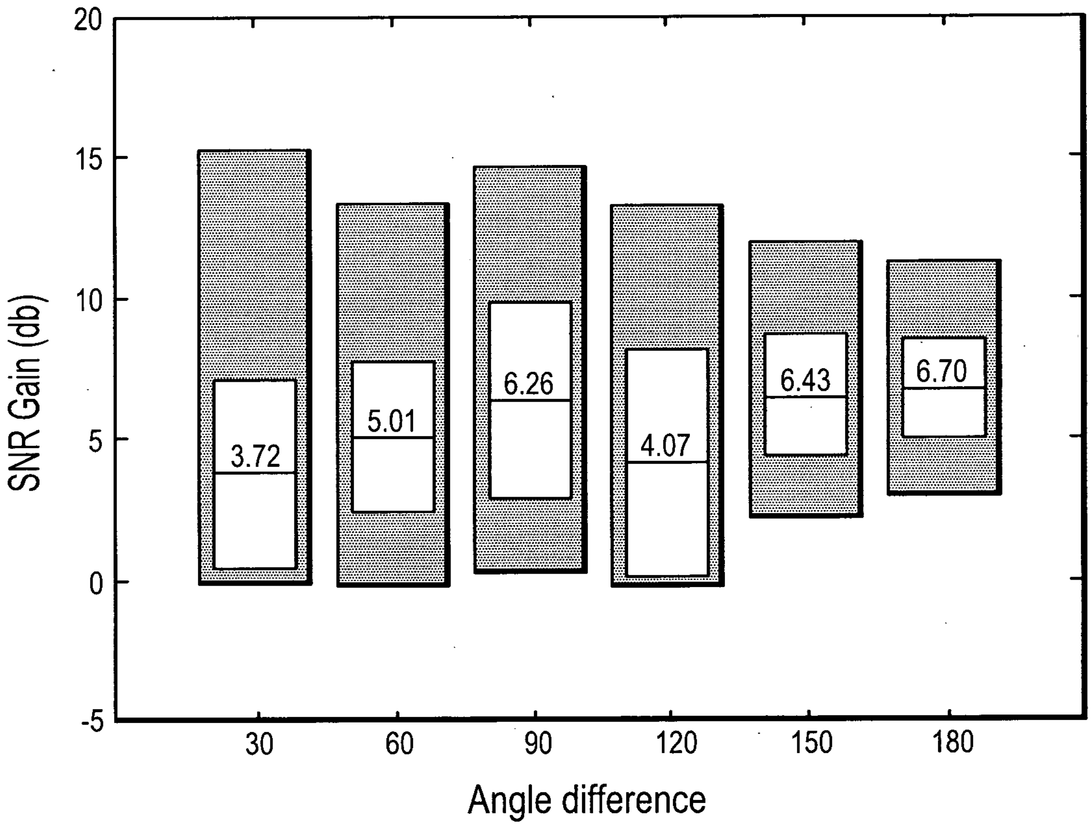

20
15
10
5
0
-5
SNR Gain (db)
3.72
5.01
6.26
4.07
6.43
6.70
30
60
90
120
150
180
Angle difference

FIG. 11

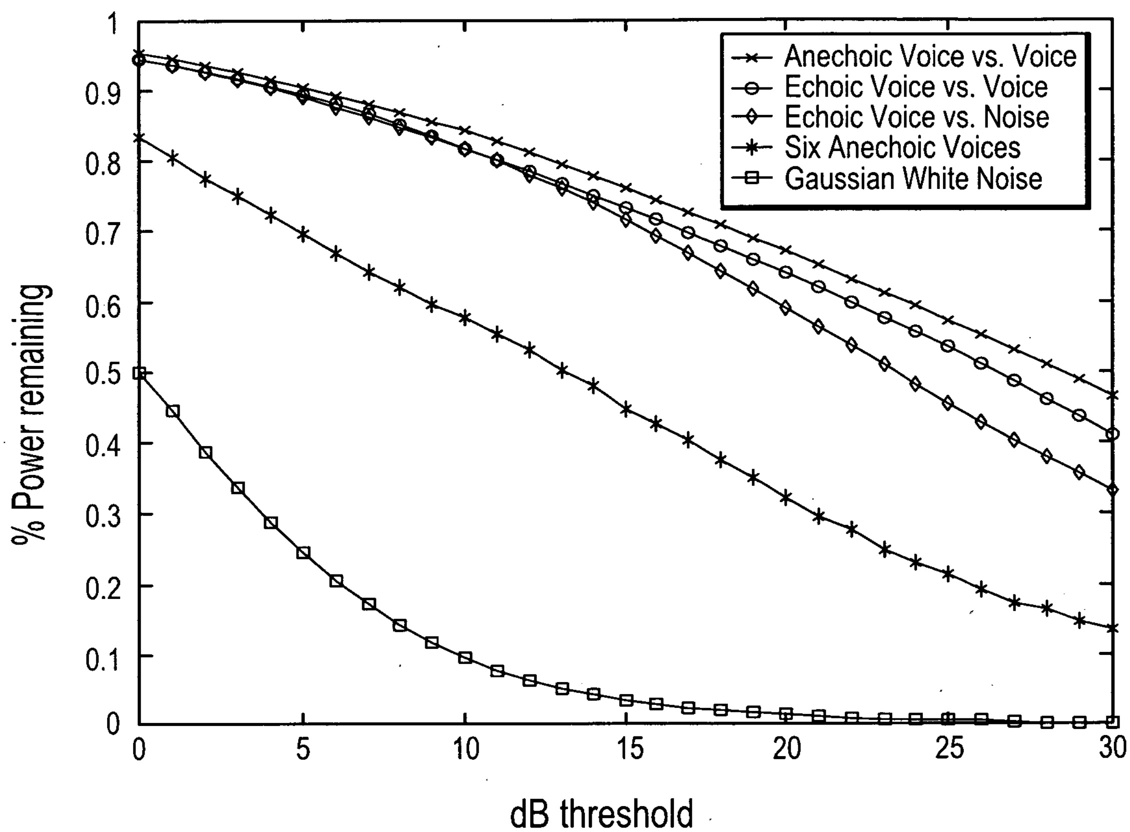

Anechoic Voice vs. Voice
Echoic Voice vs. Voice
Echoic Voice vs. Noise
Six Anechoic Voices
Gaussian White Noise
% Power remaining
dB threshold
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
5
10
15
20
25
30

FIG. 12